

**EXAMPLE 3** ► The three graphs in Figure 1-3g show three different transformations of the pre-image graph to image graphs  $y = g(x)$ . Explain verbally what transformations were done. Write an equation for  $g(x)$  in terms of the function  $f$ .

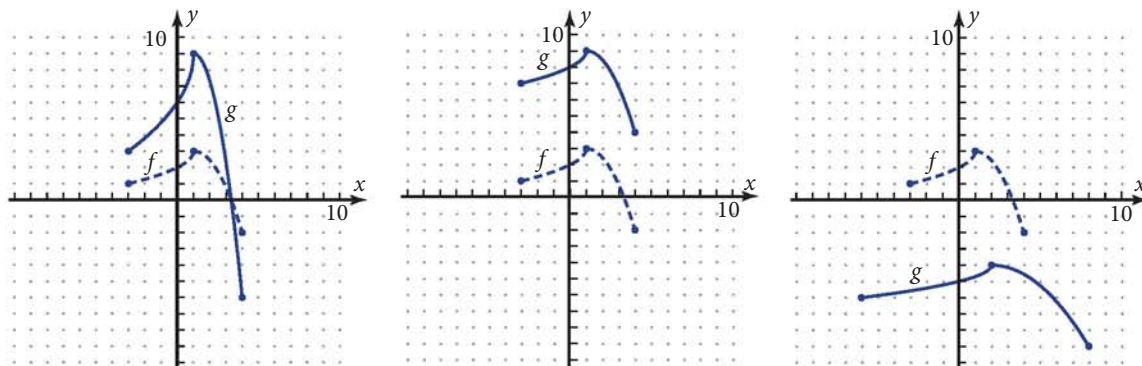


Figure 1-3g

**SOLUTION** Left graph: Vertical dilation by a factor of 3

$$\text{Equation: } g(x) = 3f(x)$$

*Note:* Each point on the graph of  $g$  is 3 times as far from the  $x$ -axis as the corresponding point on the graph of  $f$ . Note that the vertical dilation moved points above the  $x$ -axis farther up and moved points below the  $x$ -axis farther down.

Middle graph: Vertical translation by 6 units

$$\text{Equation: } g(x) = 6 + f(x)$$

*Note:* The vertical dilation moved all points on the graph of  $f$  up by the same amount, 6 units. Also note that the fact that  $g(1)$  is three times  $f(1)$  is purely coincidental and is not true at other values of  $x$ .

Right graph: Horizontal dilation by a factor of 2 and vertical translation by  $-7$  units

$$\text{Equation: } g(x) = -7 + f\left(\frac{1}{2}x\right)$$

*Note:* Each point on the graph of  $g$  is twice as far from the  $y$ -axis as the corresponding point on the graph of  $f$ . The horizontal dilation moved points to the right of the  $y$ -axis farther to the right and moved points to the left of the  $y$ -axis farther to the left. ◀

In this exploration, given a pre-image and an image graph, you'll identify the transformation.